U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
SEP. NO. 351

June 1953 Washington 25, D.C. Vol. 15, No. 6

CONSTRUCTION DETAILS OF TUNA LONG-LINE GEAR USED BY PACIFIC OCEANIC FISHERY INVESTIGATIONS

By Edwin L. Niska*

INTRODUCTION

This is a description of the long-line gear used at present by the Pacific Oceanic Fishery Investigations (POFI) to capture tunas in the central Pacific. The basic design is that employed by Japanese and Hawaiian fishermen (June 1950, Shapiro 1950), modified for ease of operation and standardization of component parts. In the past POFI has used different types of long-line gear (Murphy and Shomura ms.), and we anticipate that the design will be further changed in the future. The gear described in this report is, however, a thoroughly tested and practical gear for catching tunas and marlins up to several hundred pounds in size.

The basic unit of gear is the "basket," so called because it was originally stored in a split bamboo basket. This unit consists of a main line with a supporting float line at one end, and bearing six branch lines, each with a single hook.

MATERIALS AND COSTS

The following list of materials contains all the items that are necessary to make up one basket of POFI long-line gear:

Item	Quantity	Cost
Seine twine, cotton, No. 261 thread, hard lay	23.4 lbs.	$23.00
Preservative--"Net Life" or copper napthenate	½ gallon	.60
"Sekiyama," prefabricated No. 8 thread, Irish Linen, 12 strands, 22 ft. long	6 each	13.50
Wire rope, leader, .066" dia., 1 x 7 rt. lay, galv. mild plow, 6 ft. long	6 each	.36
Hooks, No. 9/0 or 8/0 "Mustad flatted tuna"	6 each	1.08
Sleeves, copper, "Nicopress" No. 18-1-C for 1/16" cable	12 each	.40
Snap, with swivel, Kolstrand, No. 9 AK	7 each	2.45
Rubber tubing, 1/8" I.D., 3/8" O.D., 6" long	6 each	.45
Pole, bamboo, 14-16 ft. long, butt dia. 1¼-1½ inches	1 each	.70
Strap, "Band-It," stainless steel, 3/8" width	2 feet	.12
Buckle, "Band-It," stainless steel, 3/8"	4 each	.24
Bunting, flag, Indian Head cloth, 8" x 11½"	2 each	.24

* FORMERLY FISHERY METHODS AND EQUIPMENT SPECIALIST, PACIFIC OCEANIC FISHERY INVESTIGATIONS, U. S. FISH AND WILDLIFE SERVICE, HONOLULU, T. H.

	Quantity	Cost
Rubber, air hose, 1-1/8" I.D., 5/16" wall, 14" section	1 each	.80
Tank, stainless steel, internal volume 2100 cu. inches (Army surplus)	1 each	4.75
Eye bolt, 3/8" stock 4½" long, galv.	1 each	.55
Bushing, 1/4" x 1/8" hex head, galv.	1 each	.34
Canvas skid	1 each	2.07
Manila line, 3/8" dia. med. lay	5 feet	.15
Cotton line, 1/4" dia. med. lay	14½ feet	.60
Wire rope thimbles, 3/8" galv.	1 each	.10
Misc. cotton thread, No. 6 cord, sail wax, sealing compound		.10
		$52.60

In addition, the following special tools are needed:

"Nicopress" tool No. 51-C-887	$20.00
"Band-It" tool for 3/8" strap stock	12.00
Die OS 1/8" - 27 NPT	3.00
Die ratchet	6.65
	$41.65

It should be pointed out that the prices quoted on the above list have been derived from government bid quotations as delivered in Honolulu and, because of fluctuations in market prices and shipping costs, are only estimates. The cost of $52.60 to make up one basket of long-line gear does not include the cost of labor. It requires about 10 man-hours to assemble one basket of gear.

PREPARATION OF THE LINES

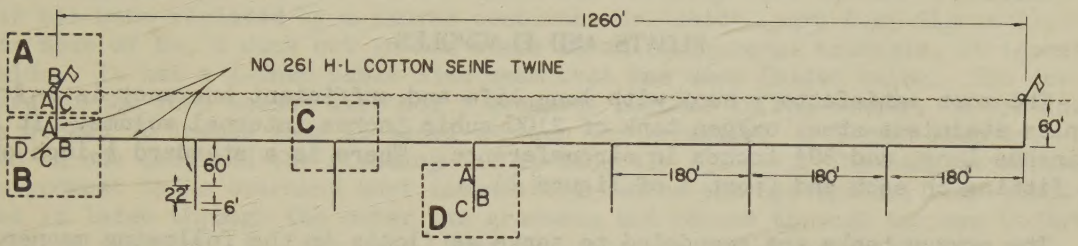
Before cutting, each skein of line is straightened and stretched to remove the kinks. Seven main-line sections, each 180 feet long, are cut and a 12-inch eye splice is made on the ends of each length.

The six branch lines are cut in 60-foot lengths. A No. 9 AK snap is attached to one end by a 1½-inch eye splice through the swivel ring. The standing end is stoppered with a Matthew Walker knot (as shown in part D of figure 1) in order to facilitate making a compact, readily breakable sheetbend around the eye of the "sekiyama."

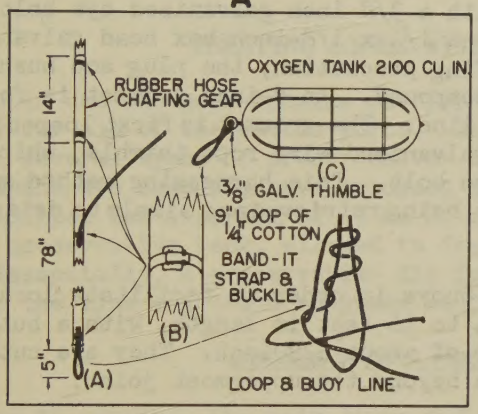
The "sekiyama" contains 12 strands of No. 8 linen twine wound with No. 6 cotton thread. It is 22 feet long and has a 3-inch eye on each end. The eyes are served with No. 6 cotton wrapping twine with a lock stitch at the base of each eye, the wrapping continuing 3 inches beyond this junction. The purpose of the "sekiyama" is to serve as an additional leader which is very strong, stiff enough to be non-kinking, and yet easy on the hands. A large fish on the hook can be worked and boated safely because the winding thread on the "sekiyama" forms a good gripping surface. The "sekiyama" also can be bent on the rail of the vessel, whereas ordinary line would soon wear out by abrasion.

Leaders are fashioned of 6-foot lengths of 1 x 7, .066-inch diameter, galvanized wire. A 3-inch loop in the end of the leader is fitted with a section of rubber tubing to reduce chafing on the "sekiyama," the loop itself being secured with a Nicopress sleeve. A flattened No. 9/0 tuna hook is attached to the leader by a 1-inch loop made with a Nicopress sleeve.

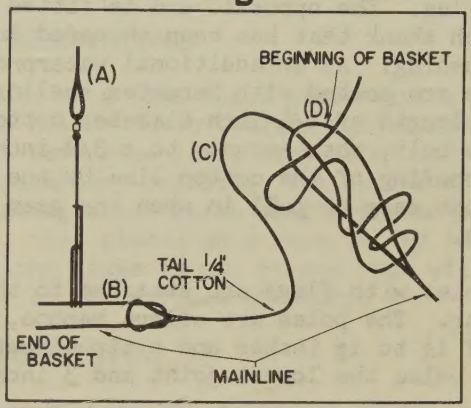
DIAGRAM OF POFI LONG-LINE GEAR



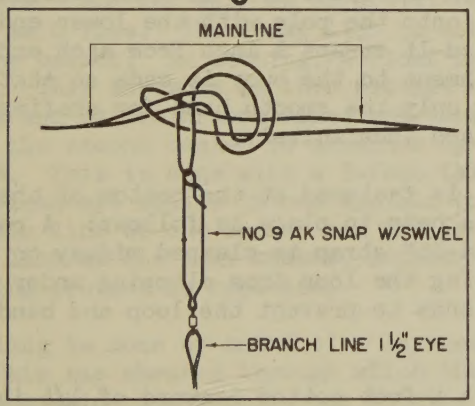
A



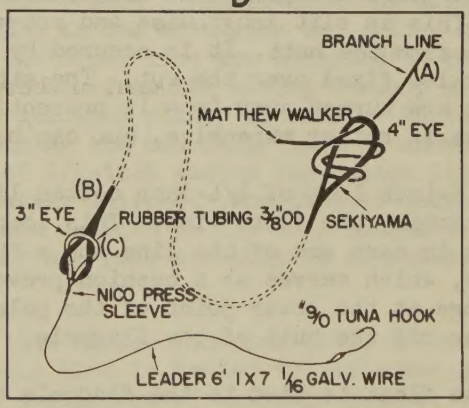
B

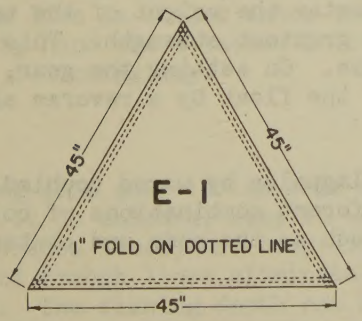


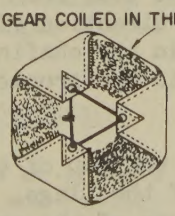
C

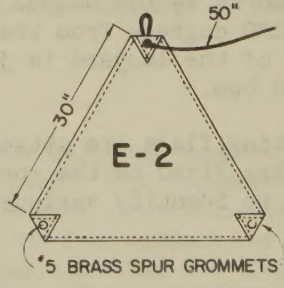


D









A 60-foot buoy line is made up for each basket. This is secured to the main line loop at the end of the basket. The surface end is fastened to the base of the flag pole (see parts A and B of figure 1).

FLOATS AND FLAGPOLES

The most satisfactory buoy with long life and sufficient buoyancy is an Army surplus stainless-steel oxygen tank of 2100 cubic inches internal volume. It is 25 inches long, and 38½ inches in circumference. There is a standard ¼-inch outlet fitting on each end (part A of figure 1).

The oxygen tanks are remodeled to serve as floats in the following manner: The outlet fittings are removed, and one end is sealed by a threaded ¼-inch galvanized plug. The opposite end is fitted with a 3/8-inch galvanized eye bolt with a 2-inch shank that has been threaded into a 1/4 x 1/8-inch hex head galvanized pipe bushing. As an additional waterproofing precaution, the plug and bushing threads are coated with Permatex sealing compound. An 8-inch grommet is formed from a length of 1/4-inch diameter cotton line. The grommet is first looped through the eye bolt, then secured to a 3/8-inch galvanized wire rope thimble, which prevents chafing of the cotton line by the eye bolt. This harnessing method makes the float easy to pull in when the gear is being retrieved and simple to detach for storage.

Poles with flags are attached to the buoys in order to facilitate locating the gear. The poles are select bamboo, 14 to 16 feet in length, with a butt diameter of 1¼ to 1½ inches and a tip diameter of about 5/8 inch. They are cut 2 inches below the lowest joint and 3 inches beyond the uppermost joint.

The poles are protected from chafing on the float by a 15-inch section of air hose. This is slit lengthwise and pressed onto the pole with the lower end 6 feet 6 inches from the butt. It is secured by Band-It straps 1 inch from each end, with the buckles fixed over the cut. The attachment to the buoy is made so that the buckles are turned away from it presenting only the smooth band for chafing. The air hose is rather expensive, but can be used indefinitely.

A 5-inch loop of 1/4-inch cotton line is fastened at the bottom of the pole for attaching the float line. This loop is held in place as follows: A rosette is made in each end of the line and a "Band-It" strap is clamped midway on the rosette, which serves as a cushion preventing the loop from slipping under the band. The ridge at the lower joint of the pole tends to prevent the loop and band from slipping off the butt of the flagpole.

The float is tied to the flagpole by a 4-foot cotton lanyard of 1/4-inch cotton line, which is secured to the flagpole just below the chafing gear by a Band-It strap. It is important that this line be fixed 90 degrees from the concave side of the bamboo so that on lifting the pole from the water the weight of the tank will be borne by the bamboo in the direction of its greatest strength. This position is 180 degrees from the slit in the chafing hose. On setting the gear, the free end of the lanyard is joined to the grommet of the float by a reverse sheet bend with bow.

Bunting flags are attached to the top of the flagpoles by waxed doubled cotton thread ties fixed to the corners of the flags. Different combinations of colors are used to identify various portions of the set, such as the ends and center,

LONG-LINE CONTAINER

The original split bamboo basket which was formerly used to hold a "basket" of gear has been replaced by a canvas container or "skid" (part E of figure 1). This is made of No. 4 duck cut in the shape of an equilateral triangle, 45 inches on a side. It has a 1-inch table size seam that has been folded twice. The corners are turned in 3 inches with No. 5 grommets punched in the center. A 3/8-inch Manila becket 50 inches long is laced through the grommets. A 3-inch loop is spliced on one end, and the standing end is securely whipped. The loop is secured on one grommet by an overhand knot immediately behind the eye splice. The standing end is laced through the other two grommets and passed through the eye to form a bight. A slip knot is then made, thus securing the long-line within the confines of the canvas skid.

TREATING LINES WITH PRESERVATIVES

When in use the gear remains wet for weeks at a time and a preservative is necessary for all of the cotton parts. It is not necessary to treat the "sekiyamas." Among the several types of preservatives that have been used, "Net Life" and a copper napthenate compound have produced satisfactory results. The skeins of line are cold-dipped for a period of 15 to 20 minutes, after which they are removed from the preservative tank, allowed to drain, then placed on a rack to dry in the shade. Essentially, a preservative dip for long lines should be one that will penetrate the line and leave no gummy residue on the surface when dry.

ASSEMBLY OF LINES FOR SETTING

Prior to setting, the main lines and branch lines are joined as shown in part C of figure 1 and the gear is carefully coiled, branch lines alternating with sections of main line. The float line is attached to the main line and coiled on top of the basket. In setting, a float and the float line are attached to the flagpole. This assembly is then pitched overboard from the moving vessel, and the main line and baited branch lines are thrown out with plenty of slack. In the meantime the second basket is attached by joining the two main lines as shown in figure 1B. This is done with a 3-foot tail of 1/4-inch medium lay cotton line with a 3-inch eye splice in one end and the other whipped. The loop is attached to the main line of one basket and the free end is tied to the loop in the end of the main line of the next basket, another buoy and pole assembly is attached, and the setting process is repeated.

Hauling is done by means of a Japanese line hauler (Shapiro 1950, Shimada 1951). This has sheaves through which the main line is hauled and automatically coiled on a skid placed below the machine on a platform of suitable height. Float lines and branch lines are detached as they come on board. The buoys and flags are removed and stowed, and the float lines and droppers are coiled by hand. As the main line is coiled under the line hauler, float lines and droppers previously coiled by hand are attached in the proper places so that the "basket" is ready for use the following day.

DISCUSSION

Long-line gear is the best means at present known for catching deep-swimming tunas. It is uniform, easy to work, and readily constructed. The component main lines, branch lines, and buoy lines are all made from the same material. Uniform length of branch lines eliminates confusion in assembly and replacement during the pick-up. The fishing depth can be regulated as desired by altering the length of the buoy lines and the amount of sag in the main line. Tangling of adjacent branch

lines is not frequent because the distance between any two branch lines is more than twice their length. The use of one large float between baskets, instead of two or more smaller floats, reduces the amount of handling and expedites operations. Snaps with swivels placed at the uppermost part of the branch lines minimize twisting when a hooked fish is threshing about. The snaps allow for instantaneous assembly or disassembly of the branch lines or buoy line with the main line. The manner of construction lends itself to mass production methods.

LITERATURE CITED

JUNE, FRED C.
1950. PRELIMINARY FISHERIES SURVEY OF THE HAWAIIAN-LINE ISLANDS AREA. PART I. THE HAWAIIAN LONG-LINE FISHERY. U. S. FISH AND WILDLIFE SERV. SEP. NO. 244, PP. 1-16.

MURPHY, G. I. AND SHOMURA, RICHARD
1952. LONG-LINE FISHING FOR DEEP-SWIMMING TUNAS IN THE CENTRAL PACIFIC, JULY 1950-SEPTEMBER 1951. MS.

SHAPIRO, SIDNEY
1950. THE JAPANESE LONG-LINE FISHERY FOR TUNAS. U. S. FISH AND WILDLIFE SERV. SEP. NO. 249, PP. 1-26.

SHIMADA, BELL M.
1951. JAPANESE TUNA-MOTHERSHIP OPERATIONS IN THE WESTERN EQUATORIAL PACIFIC OCEAN. U. S. FISH AND WILDLIFE SERV., COMMERCIAL FISHERIES REVIEW, VOL. 13, NO. 6 (JUNE 1951), PP. 1-26.